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*Indian Standard*

# METHOD FOR DETERMINATION OF STRENGTH OF DISPERSE DYES FOR POLYESTER BY SCREEN PRINTING

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# *Indian Standard*
# METHOD FOR DETERMINATION OF STRENGTH OF DISPERSE DYES FOR POLYESTER BY SCREEN PRINTING

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# *Indian Standard*
# METHOD FOR DETERMINATION OF STRENGTH OF DISPERSE DYES FOR POLYESTER BY SCREEN PRINTING

## 0. FOREWORD

**0.1** This Indian Standard was adopted by the Indian Standards Institution on 31 March 1986, after the draft finalized by the Dyestuffs Sectional Committee had been approved by the Textile Division Council.

**0.2** Disperse dyes are marketed in large number of varieties in powder or paste form with different strengths and sometimes even as mixtures also. These dyes are mainly used for colouring hydrophobic fibres, such as cellulose acetate, triacetate, polyester, polyamide and polyacrylonitrile.

**0.3** The method prescribed in this standard is a general method and whereever special instructions are given by the manufacturers, these should be followed while carrying out screen printing using the dyestuff. In order to compare the strength and shade of the dyestuff under test and the standard dyestuff, screen printing on 67/33 polyester/cotton fabric is recommended in two standard depths ( *see* Appendix A ).

**0.4** In reporting the results of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

## 1. SCOPE

**1.1** This standard prescribes a method for evaluating strength and shade of disperse dyes for polyester by hand screen printing.

## 2. TERMINOLOGY

**2.0** For the purpose of this standard the following definitions shall apply.

**2.1 Depth of Print** — It is the amount of dyestuff in g per 100 g of the printing paste used for printing.

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*Rules for rounding off numerical values ( *revised* ).

**2.2 Strength of Dyestuff** — It is the actual dye content in g per 100 g of the sample of dyestuff expressed as a percentage.

## 3. STANDARD DYESTUFF

**3.1** The standard dyestuff against which the strength of the dyestuff under test is evaluated, shall be as agreed to between the buyer and the seller.

## 4. APPARATUS

**4.1 Laboratory Scale Screen Printing Table Together with a Screen and Squeegee to Give Stripe Design**

**4.2 Steel Rod** — 15-20 cm long for stirring purpose.

**4.3 Stainless Steel Vessel of 2 Litres Capacity** — To prepare stock thickening.

**4.4 Glass or Stainless Steel Containers** — Twelve each of 500 ml capacity, for preparation of printing paste.

**4.5 Steaming Chamber** — Capable for steaming at 2·1 kg/cm$^2$ ( 30 psi ) pressure and with capacity to hold 24 specimens of 20 × 20 cm$^2$ size.

**4.6 Water Bath** — Provided with heating arrangement.

**4.7 Electric Iron with Energy Regulator**

**4.8 Weighing Balance** — Capable of weighing acurately up to 1 mg.

**4.9 Weighing Scale** — Capacity up to 5 kg and capable of weighing accurately up to 1 g.

## 5. REAGENTS

**5.1 Quality of Reagents**

**5.1.1** Unless otherwise specified, 'pure chemicals' shall be employed in tests and distilled water shall be used where the use of water as reagent is intended ( *see* IS:1070-1977* ).

NOTE — 'Pure Chemicals' shall mean chemicals that do not contain impurities which affect the test results.

**5.2 A Suitable Thickener** — Preferably modified guar gum with *p*H adjusted to **5.5** by adding citric acid or tartaric acid.

**5.3 Sodium Chlorate Powder or Aqueous Solution**

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*Specification for water for general laboratory use ( *second revision* ).

**5.4 Citric Acid** — ( *See* IS: 5464-1970* ).

**5.5 Sodium Hydroxide Flakes**

**5.6 Sodium Hydrosulphite Powder** ( $Na_2S_2O_4$ ) — *See* IS: 1919-1961†.

**5.7 Sulphuric Acid** — 70 percent ( *m/m* ), specific gravity 1·629 at room temperature.

**5.8 A 5 Metres Well Scoured, Bleached and Heat-set Piece of 67/33 Polyester/Cotton Fabric of Plain Weave** — The fabric shall not be treated with optical whitening agents.

NOTE — 100 percent well scoured, bleached and heat-set polyester fabric in plain weave may also be used. In this case carbonization treatment as given in **6.10** is not required.

**5.9 A Non Ionic Synthetic Detergent** — Based on polyethylene glycol.

## 6. EVALUATION OF STRENGTH OF DYESTUFF

### 6.0 Procedure

**6.1** Prepare stock thickening using following reagents:

a) Suitable thickener — 80 parts,

b) Sodium chlorate ( solid content ) — 2 parts,

c) Citric acid — 4 parts, and

d) Water — to make up to 1 000 parts.

Slowly add the thickener ( *see* **5.2** ), sodium chlorate and citric acid to water. Stir for 15 minutes at room temperature so as to obtain a homogeneous paste.

**6.2** Prepare the stock printing paste using following reagents for the standard dyestuff and the dyestuff under test separately:

a) Standard disperse dye — 10 g,

b) Warm water ( 40 to 50°C ) — 30 g, and

c) Stir well.

Add 60 g of stock thickening as prepared in **6.1** so as to make total stock printing paste of 100 g. For dyestuff under test prepare stock printing paste of 400 g with 40 g dye, 120 g warm water and 240 g stock thickening.

---

*Specification for citric acid, monohydrate.

†Specification for sodium hydrosulphite ( *first revision* ).

**6.3** Prepare separately the required printing paste for the standard dyestuff for the depths as recommended in Appendix A as follows:

Stock printing paste — $X$ parts by mass where $X$ = recommended depth × 10

Stock thickening — 35 parts by mass, and

Warm water — To make up to 100 parts by mass and stir thoroughly.

**6.4** Take 5 m of 67/33 polyester/cotton fabric and print it with the printing pastes of two recommended depths of standard dyestuff as prepared in **6.3** by hand screen printing (in two strokes in forward and backward direction) on one side of the fabric and mark the printed area for identification.

NOTE 1 — The polyester/cotton fabric used should be well desized, scoured, bleached, soured and heat-set. The *p*H of the cloth ready for printing should be neutral or slightly acidic and never alkaline. The fabric shall not be finished and treated with optical whitening agent. Before printing, it shall be ironed to remove all creases and folds.

NOTE 2 — The pressure applied on the screen by hand through squeegee should be normal and uniform throughout while printing so as to get uniform and even prints. Excessive pressure should be avoided.

**6.5** Prepare suitable quantity of 24 printing pastes in 0·5, 1·0, 1·5, 2·0, 2·5, 3·0, 3·5, 4·0, 4·5, 5·0, 5·5. 6·0, 6·5, 7·0, 7·5, 8·0, 8·5, 9·0, 9·5, 10·0, 10·5, 11·0, 11·5 and 12 percent depth of dyestuff under test in a similar way as in **6.3** except that the amount of stock printing paste to be taken is calculatad by using the following formula:

Amount of stock printing paste required = Percent depth of printing paste required × 10.

**6.6** Print with printing pastes of different depths as in **6.5** separately similar to the procedure followed **6.4** side by side on the polyester/cotton fabric (*see* **6.4**) and mark the printed areas for identification.

**6.7** Dry the printed fabric on screen printing table. Cut 20 × 20 cm specimens of printed fabric with all the different depths as printed in **6.4** and **6.6** and steam them in the steaming chamber at 2·1 kg/cm$^2$ (30 psi) pressure for 30 minutes.

**6.8** Treat all the specimens of printed fabric separately after steaming, in baths containing 2 g/l sodium hydroxide and 2 g/l sodium hydrosulphite powder at 60-70°C for 15-20 minutes and at material to liquor ratio of 1:20.

**6.9** Rinse all the specimens well in tap water and dry them on screen printing table.

**6.10** Carbonise all the printed specimens separately in baths each containing 70 percent ( *m/m* ) sulphuric acid and 10 to 20 g/l of urea or sulphamic acid at room temperature for 30 minutes.

**6.11** Rinse the carbonized specimens thoroughly in tap water and wash them separately in 2 g/l suitable detergent ( *see* **5.9** ) at boil for about 20 minutes. Rinse well, dry and iron all the specimens ( on the reverse ).

**6.12** Select two prints of the dyestuff under test which exactly match with the prints of the standard dyestuff. Note the percentage depths of the prints of the dyestuff under test which match with the two prints of recommended depths of the standard dyestuff. Also find out the variation in depths, if any, from the standard depths ( *see* Notes 1 *and* 2 ).

NOTE 1 — Before comparison of prints, the specimens should be spread out, ironed properly and laid side by side in the same plane and oriented in the same direction. The consistency in depth variation of different prints of standard dyestuff and the dyestuff under test should be observed. If the depth variations between the two consecutive printings are not constant, the printing should be repeated. Moreover it should be ensured that prints are uniform and free from printing defects like colour spreading, overlapping of design, etc. Matching should be done on a perfectly white background.

NOTE 2 — The strength of the sample should be expressed on comparisons of printings obtained as in **6.11**. The variation in shade should be reported in the reduction printings as obtained in **6.11**.

## 7. CALCULATIONS

**7.1** Calculate the strength of dyestuff under test for each recommended depth of standard dyestuff by the following formula:

$$S = \frac{A}{B} \times 100$$

where

$S$ = strength of dyestuff under test in percent;

$A$ = depth of printing of the standard dyestuff;

$B$ = depth of printing of the dyestuff under test which exactly matches with that of the standard dyestuff.

**7.2** Calculate the average of the two values of $S$ as obtained in **7.1**.

## 8. REPORT

**8.1** Report the value obtained as in **7.2** as the strength in percent of the dyestuff under test as compared to the standard dyestuff.

**8.1.1** Report also the variation in depth in comparison with the depth of the printing paste of standard dyestuff.

## 9. SAMPLING

**9.1 Lot** — All the containers of the same dyestuff and of the same strength delivered to a buyer against one despatch note shall constitute a lot.

**9.2** Unless otherwise agreed to between the buyer and the seller, the number of containers to be selected at random from a lot shall be as given below:

| *Lot Size* | *Sample Size* |
|---|---|
| Up to 15 | 2 |
| 16 to 25 | 3 |
| 26 to 50 | 4 |
| 51 to 100 | 5 |
| 101 to 150 | 6 |
| 151 to 300 | 7 |
| 301 and above | 8 |

**9.3** If the dye is marketed in powder form, draw from each container as selected in **9.2** a small quantity of the dye by a suitable sampling instrument from three different parts and mix thoroughly to get a composite sample weighing about 20 g. This shall constitute the test sample.

**9.4** For dyes marketed in liquid emulsion or paste form, shake each container as selected in **9.2** thoroughly so as to homogenize the dye dispersion and then draw the test sample as given in **9.3**.

# APPENDIX A

## RECOMMENDED STANDARD DEPTHS FOR EVALUATION OF STRENGTH OF DYESTUFF

( *Clauses* 0.2, 6.3, 6.12 *and* 7.1 )

| Sl No. | Hue of Dyestuff | Recommended Percent Standard Depth |
|---|---|---|
| 1. | Black and navy blue | 1 and 6 |
| 2. | Others | 1 and 4 |

( *Continued from page* 2 )

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# INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

## Base Units

| *Quantity* | *Unit* | *Symbol* |
|---|---|---|
| Length | metre | m |
| Mass | kilogram | kg |
| Time | second | s |
| Electric current | ampere | A |
| Thermodynamic temperature | kelvin | K |
| Luminous intensity | candela | cd |
| Amount of substance | mole | mol |

## Supplementary Units

| *Quantity* | *Unit* | *Symbol* |
|---|---|---|
| Plane angle | radian | rad |
| Solid angle | steradian | sr |

## Derived Units

| *Quantity* | *Unit* | *Symbol* | *Definition* |
|---|---|---|---|
| Force | newton | N | 1 N = 1 kg. m/s$^2$ |
| Energy | joule | J | 1 J = 1 N.m |
| Power | watt | W | 1 W = 1 J/s |
| Flux | weber | Wb | 1 Wb = 1 V.s |
| Flux density | tesla | T | 1 T = 1 Wb/m$^2$ |
| Frequency | hertz | Hz | 1 Hz = 1 c/s (s$^{-1}$) |
| Electric conductance | siemens | S | 1 S = 1 A/V |
| Electromotive force | volt | V | 1 V = 1 W/A |
| Pressure, stress | pascal | Pa | 1 Pa = 1 N/m$^2$ |